Correlation Between Lower Extremity Injury And Core Stability In Cricket Fast Bowlers – A Observational Study

by

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of the requirements for the degree of

MASTER OF PHYSIOTHERAPY (MPT)

In

SPORTS PHYSIOTHERAPY

Under the guidance of

DR. Asifuzzaman Shahriyar Ahmed

Professor

ABHINAV BINDRA SPORTS MEDICINE & RESEARCH INSTITUTE

Bhubaneswar, Odisha

2021-2023

DECLARATION BY THE CANDIDATE

I, AMIT KALPANA ADHAV hereby declare that this dissertation entitled **CORRELATION BETWEEN LOWER EXTREMITY INJURY AND CORE STABILITY IN FAST BOWLERS** is a bonafide and genuine research work carried out by me under the guidance of DR. ASIFUZZAMAN SHAHRIYAR AHMED, PROFESSOR, Abhinav Bindra Sports Medicine And Research Institute, Odisha.

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Place: ODISHA

NAME: AMIT KALPANA ADHAV

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Seal &Signature of Principal

Dr. CHINMAYA KUMAR PATRA (PT)

Date:

Place:

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ABSTRACT

CORRELATION BETWEEN LOWER EXTREMITY INJURY AND CORE STABILITY IN FAST BOWLERS – A OBSERVATIONAL STUDY

Background: Cricket is one of the most popular game in India played by men and women with an increase risk of injuries. Core muscle strength is important to prevent risk of injuries in elite cricketers . The beginners in the cricket must have enough strength of core muscles , as a core is the bridge between upper and lower limbs So ,it should be strong enough to prevent low back and lower limb injuries in cricketers. Core muscles consist of the diaphragm at the upper section, abdominals and obliques at the front and lateral section, paraspinals and gluteals at the back and pelvic floor and hip junction at the lower section. Core acts at the center of the kinetic chain, is an essential component that helps to maximize athletic function. Upper limb and lower muscles must work coherently with the core muscles to execute controlled and coordinated movements. The aim of this study was to correlate the lower extremity injury and core stability in fast bowlers.

Methods: Fifty elite fast bowlers aged between 18-30 years of age were purposely assigned for the observational study (n=50). The core stability was assessed by using McGill torso endurance test and the lower extremity function was assessed by lower extremity functional scale.

Results: There was overall weak correlation between lower extremity injury and core stability When the lower extremity functional scale compared with McGill torso test it shows weak correlation ($p>0.05$). Flexor endurance test($r = 0.027$) , (p value = 0.530) . Extensor endurance test ($r = 0.1896$), (p value = 0.291). Side flexion right side ($r = 0.2079$), (p value = 0.291). Side flexion left side ($r = 0.1894$), (p value = 0.834).

Interpretation and conclusion: The result shows that there is a weak correlation between lower extremity injury and core stability in fast bowlers as lower extremity functional scale and McGill torso endurance test compared. But when the McGill torso endurance test (flexor endurance test ,

extensor endurance test and side plank left side and right side all these tests compared with each other they shown a significant correlation among each other).

Keywords: Cricket , Fast bowlers, Lower extremity injury, Core stability , lower extremity functional scale , McGill torso endurance battery.

CORRELATION BETWEEN LOWER EXTREMITY INJURY AND CORE STABILITY IN FAST BOWLERS

INTRODUCTION

CRICKET is one of the most popular game in India played by men and women with an increase risk of injuries. Core muscle strength is important to prevent risk of injuries in elite cricketers . The beginners in the cricket must have enough strength of core muscles , as a core is the bridge between upper and lower limbs So ,it should be strong enough to prevent low back and lower limb injuries in cricketers.[1]

Core stability is defined as the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities core stability and core strength have been subject to research since the early 1980s. The core region is the region of the body consisting of muscles and joints of the abdomen, the lower back , the pelvic and the hips.[2]

These core muscles have dual roles . The first role is to protecting [stabilizing] the spine from excessive force , the second role is in the criterion transfer of force in a proximal to distal sequence (Brumitt,2010). Core muscle activity is to best understood as the preprogrammed integration of local , single joint muscle and multi joint muscles to provide stability and produce motion (Keebler , Press and Sciatica, 2006).[3]

Core muscles consist of the diaphragm at the upper section, abdominals and obliques at the front and lateral section, paraspinals and gluteals at the back and pelvic floor and hip junction at the lower section. Core acts at the center of the kinetic chain, is an essential component that helps to maximize athletic function. Upper limb and lower muscles must work coherently with the core muscles to execute controlled and coordinated movements. [4]

Core stability allows the athletes to maximize force production while minimizing loads placed on peripheral joints. Core instability maximizes the loads on peripheral joints which results in excessive accessory gliding thereby increasing risk for dysfunction, injury and pain. Researchers found that core endurance tests are the most reliable measurements for core stability, followed by the flexibility, strength, neuromuscular control, and functional tests, respectively. [5]

McGill core endurance test battery which includes flexor endurance, extensor endurance, right side plank test and left side plank test was adopted in this observational study.[6]

NEED OF STUDY

The study should be conducted with the purpose to examine the co-relation between the core muscles and the lower extremity injuries in the bowlers by using the McCGill torso endurance test and lower extremity functional scale.

Core helps to control body effectively helping to use arms and legs to the best advantage preventing excess stress on the lower extremities and from bending or flexing unintentional.

REVIEW OF LITERATURE

Krishna et al observed no statistical correlation between core endurance scores and shoulder dysfunction among recreational cricket players. Correlation between shoulder dysfunction and trunk flexor endurance with the p value of 0.977 (>0.05), trunk extensor endurance with the p value of 0.183 (>0.05), trunk right side flexor endurance with the p value of 0.505 (>0.05), trunk right side flexor endurance with the p value of 0.680 (>0.05).

This study observes no statistical significant correlation between core endurance scores and shoulder dysfunction among recreational cricket players.

Hilligan et al found that well developed core stability has a positive effect on bowling speed. Thirty asymptomatic indoor Action Cricket fast and fast-medium bowlers were divided into two groups of 15 each, with Group A having well-developed core stability and group B having poorly-developed core stability. The concept of matched pairs was used for age and cricket experience in order to maintain homogeneity between the groups. The core stability and bowling speed of each participant was measured using a pressure biofeedback unit (PBU) and speed sports radar respectively. SPSS version 15.0 was used to analyse the data.

Pooja CA et al compared core stability with bowling speed in male cricket medium and medium fast bowlers and found that Core stability is the ability to control the position and motion of the trunk over the pelvis and legs to allow optimum production, transfer, control of force and motion to the terminal segment in integrated kinetic chain activities. The subjects with well-developed core stability bowled significantly faster than the subjects with poorly-developed core stability. Keywords: Core Stability, Bowling Speed, Medium Fast Bowlers and Medium Bowlers.

Mangesh et al found that comparison of core stability in different sportsmen , football players have a higher core endurance followed by sprinters, cricket fast bowlers and badminton players. Eighty participants in total were included in the study (twenty each from the above-mentioned sport). Demographic data, participation consent, and other data pertaining to their sport were taken, and they were instructed to perform core endurance tests which included the 60° flexion test, trunk extensor endurance test, right side plank test, and left side plank test. Analysis included a one-way analysis of variance (ANOVA) to determine the difference between the four groups.

Fallon et al in their study determine the differences in core stability measurements in power production, agility, and dynamic stability in collegiate male and female lacrosse players as well as to assess the relationship of core stability to measures of athletic performance. The primary results indicate that there were no relationships between core stability and the performance tests in collegiate male and female lacrosse players. Males completed the pro-agility shuttle significantly faster and produced significantly more power in the CMJ than females. A relationship was found between agility measurements and the prone plank hold in the participants as a group and not specific to sex.

AIM

To evaluate the relation between core stability and lower extremity injuries in bowlers.

OBJECTIVE

- To determine the core stability by using McGILL torso endurance test
- To determine the lower extremity function by measuring with the lower extremity functional scale

RESEARCH QUESTION

Is there any correlation between lower extremity injury and core stability in fast bowlers?

METHODOLOGY

- **Sampling-** Purposive sampling
- **Study Design-** Observational study
- **Population-** Fast Bowlers
- **Location-** Adarsh cricket academy, Pimpri Chinchawad , Pune , Maharashtra
- **Outcome Measures**- McCgill's torso muscular endurance test , lower extremity functional scale
- **Sample Size**- 50

MATERIALS REQUIRED

- Stopwatch
- Yoga mat
- Plinth
- Pen
- Writing pad
- Writing paper

INCLUSION CRITERIA

- Age- 18 -30
- Male bowlers
- Experience of 1-2 years

EXCLUSION CRITERIA

- Any recent MSK injuries
- Any recent surgery done
- Recent trauma.
- Bowlers who get pain during and after playing game or during performing test.
- Not under specific core endurance training other than their routine exercise

PROCEDURE

- Ethical Approval was taken Consent of the subject was taken.
- Explanation and demonstration of technique was given.
- Pre-assessment was taken Assessing by respective test Data was analyze
- McGill 's TORSO ENDURANCE TEST
- Back Extensor Test.
- Side Bridge Test for Right and Left side
- Flexor Endurance Test.
- Lower extremity functional scale.

OUTCOME MEASURE

Trunk flexor endurance test
Time to completion: _____

Trunk lateral endurance test
Right side time to completion: _____ Left side time to completion:_____

Trunk extensor endurance test
Time to completion: _____

Ratio of Comparison	Criteria for Good Relationship Between Muscles
Flexion:extension	Ratio less than 1.0
Right-side bridge:left-side bridge	Scores should be no greater than 0.05 from a balanced score of 1.0
Side bridge (each side):extension	Ratio less than 0.75

Flexion:extension ratio: _____ Rating: ❑ Good ❑ Poor

Right-side bridge:left-side bridge ratio: _____ Rating: ❑ Good ❑ Poor

Side-bridge (each side):extension ratio: _____ Rating: ❑ Good ❑ Poor

Trunk Flexor Endurance Test

The flexor endurance test is the first in the battery of three tests that assesses muscular endurance of the deep core muscles (i.e., transverse abdominis, quadratus lumborum, and erector spinae). It is a timed test involving a static, isometric contraction of the anterior muscles, stabilizing the spine until the individual exhibits fatigue and can no longer hold the assumed position.

Procedure :

- The starting position requires the subject to be seated, with the hips and knees bent to 90 degrees, aligning the hips, knees, and second toe.
- Instruct the subject to fold his arms across the chest, touching each hand to the opposite shoulder, lean against a board positioned at a 60-degree incline, and keep the head in a neutral position It is important to ask the subject to press the shoulders into the board and maintain this “open” position throughout the test after the board is removed. Instruct the client to engage the abdominals to maintain a flat-to-neutral spine.

- The goal of the test is to hold this 60-degree position for as long as possible without the benefit of the back support.

Trunk extensor endurance test

The trunk extensor endurance test is generally used to assess muscular endurance of the torso extensor muscles (i.e., erector spinae, longissimus, iliocostalis, and multifidi). This is a timed test involving a static, isometric contraction of the trunk extensor muscles that stabilize the spine.

Procedure

- The starting position requires the subject to be prone, positioning the iliac crests at the table edge while supporting the upper extremity on the arms, which are placed on the floor or on a riser.
- While the subject is supporting the weight of his or her upper body, anchor the subject lower legs to the table using a strap.

The therapist has to use his own body weight to stabilize the client's legs.

- The goal of the test is to hold a horizontal, prone position for as long as possible.

Once the subject falls below horizontal, the test is terminated.

In all the above test, the subjects were asked to hold the estimated position as long as possible , any deviation or change in the position gives an indication that the subject is experiencing fatigue or no longer able to hold the position.

2 min rest is also given after performing each test for the proper execution of following tests.

LOWER EXTREMITY FUNCTIONAL SCALE-

Activities		*Exteme Difficulty or Unable tn Perform Activity*	*Quite a Bit of Difficulty*	*Moderate Difficulty*	*A Little Bit of Difficulty*	*No Difficulty*
a.	Any of your usual work, housework, or school activities.	0	1	*2*	3	4
b.	Your usual hobbies, recreational or sporting activities.	0	1	*2*	3	4
c.	(ictting into or out of the bath.	0	1	*2*	3	4
d.	Walking between rooms.	0	i	*2*	3	4
e.	Putting on your shoes or socks.	0	i	*2*	3	4
f.	Squatting.	0	i	*2*	3	4
8	I if ting an object, like a bag of groceries from the floor.	0	i	2	3	4
h.	Performing light activities around your home.	0	1	2	3	4
L	Performing heaving activities around your home.	0	1	*2*	3	4
i-	Getting into or out of a car.	0	)	*2*	3	4
k.	Walking 2 blocks.	0	1	*2*	3	4

L	Walking a mile.	0	1	*2*	3	4
m.	Going up or down 10 stairs (about 1 flight of stairs).	0	i	*2*	3	4
n.	Standinffor 1 hour.	0	1	*2*	3	4
o.	Sitting for 1 hour.	0	i	*2*	3	4
F*	Running on even ground.	0	i	*2*	3	*4*
q-	Running on uneven ground.	0	1	2	3	4
r.	Making sharp turns while running fast.	0	1	2	3	4
s.	Hopping.	0	1	2	3	4
L	Rolling over in bed.	0	1	2	3	4
Column Totals:						

LEFS score = SUM (points for all 20 activities)

Interpretation:

Minimum score: 0 Maximum score: 80

The lower the score the greater the disability . The Minimal Detectable Change (MDC) is 9 scale points. The Minimal clinically Important Difference (MCID) is 9 scale points.

Percent of maximal function = (LEFS score) / 80 * 100 Performance:

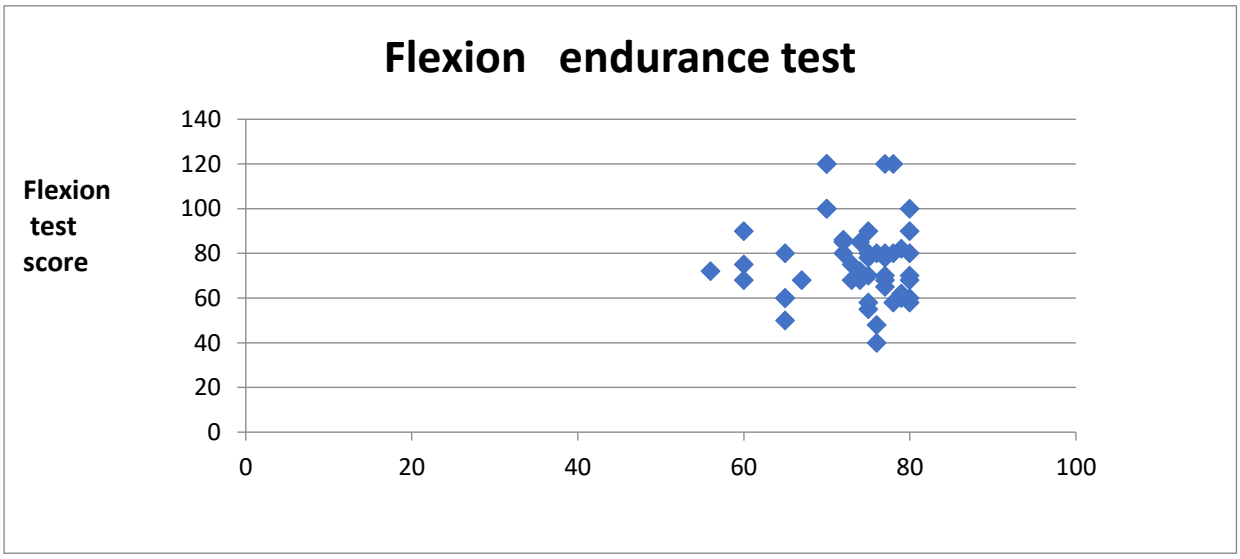
The potential error at a given point in time was +/ 5.3 scale points. Test-retest reliability was 0.94.

DATA ANALYSIS AND INTERPRETATION

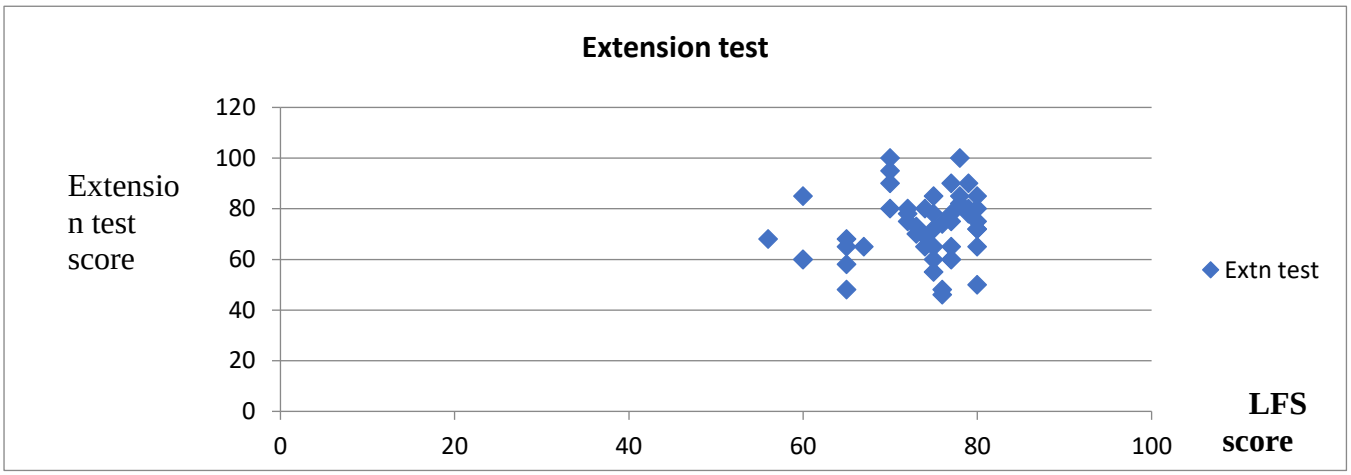
Data was analyzed using statistical package SPSS 22. Normality of the data was assessed using and level of significance was set at p> 0.05.

Normality of the data was assessed using Shapiro – wilk test. Spearman correlation correlation was used to find out correlation between variables.

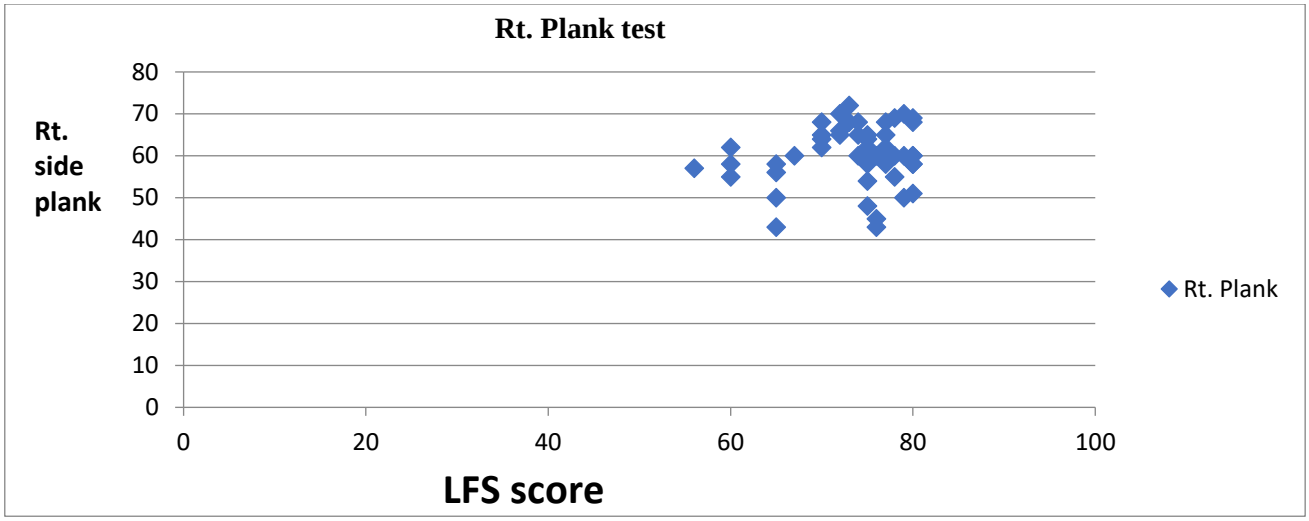
Spearman's rho correlation	Correlation Coefficient LEFS	P value
LFS score and Flexor endurance	0.02715	0.530
LFSscore and Extensor endurance	0.1896	0.291
LFS score and Side flexor endurance R	0.2079	0.708
LFS score and Side flexor endurance L	0.1894	0.834



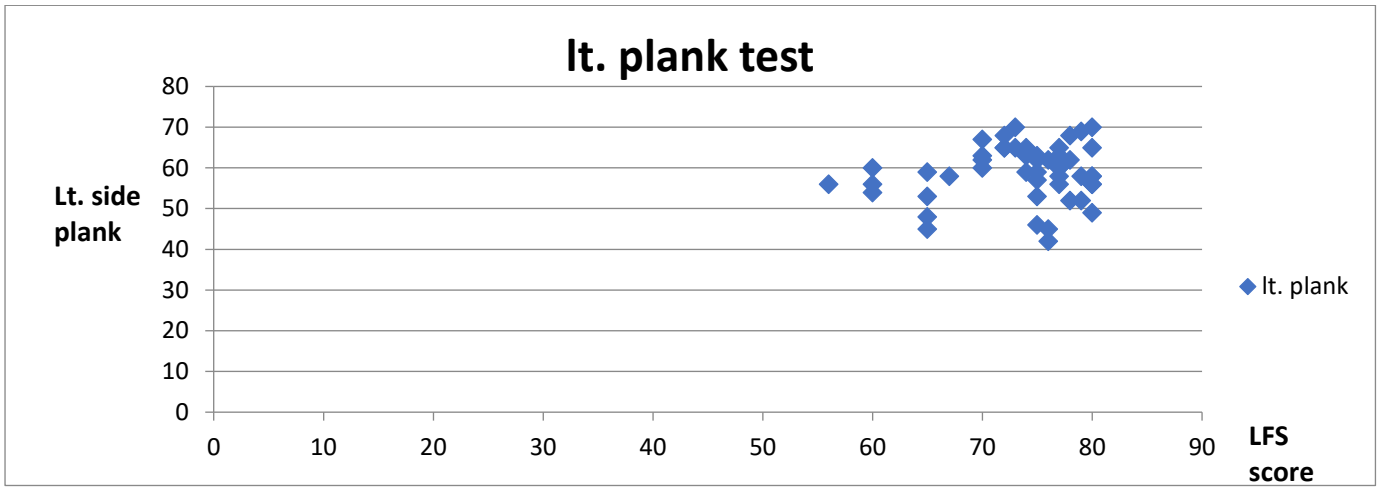
Interference- There is statically non- significant weak correlation (rho = 0.02715) between core strength and lower extremity injury in flexor endurance test .



Interference - There is statically non- significant weak correlation (rho = 0. 1896) between core strength and lower extremity injury in extensor endurance test .



Interference - There is statically non- significant weak correlation (rho = 0.2079) between core strength and lower extremity injury in flexor endurance right side .



Interference - There is statically non- significant weak correlation (rho = 0.1894) between core strength and lower extremity injury in flexor endurance left side.

RESULT

The correlation between core strength and lower extremity injury was calculated by the Spearman's regression and correlation method .

There is statically non- significant weak correlation (rho = 0.02715) between core strength and lower extremity injury in flexor endurance test P value = 0.530

There is statically non- significant weak correlation (rho = 0. 1896) between core strength and lower extremity injury in extensor endurance test P value = 0.291

There is statically non- significant weak correlation (rho = 0.2079) between core strength and lower extremity injury in flexor endurance right side . P value 0.708

There is statically non- significant weak correlation (rho = 0.1894) between core strength and lower extremity injury in flexor endurance left side P value = 0. 834

When McGill

And according to the McGill muscular endurance test sheet 20% of the bowlers had poor core strength.

DISCUSSION

A faster bowler should be perfectly balanced at the point of delivering ball. In the kinematic chain of the throwing athlete the force delivery mechanism is the arm while the shoulder functions as a funnel, which regulates the force.[1]

The generators of the force are the ground, legs, and trunk. The throwing force generating capability of the shoulder in itself is not large, viz for the shoulder segment to function properly in these athletes, contributions are required from other body segments to generate the necessary forces for ball propulsion as well as to transfer the forces to more distal segments. In this phase there is a 'controlled falling' during which there is a change from potential energy (PE) to kinetic energy[2].

The phases of bowling includes firstly, run-up when the bowler walks or jogs over his approach marker, gradually increasing speed on his approach to wicket. Second phase includes the pre- delivery stride this stage separates the run-up from delivery stride and begins, for a right- handed bowler with a jump off the left foot is completed lands on the right foot or back foot. And last phase called the delivery stride where the bowler releases the ball with bending forward taking all his body weight on the back foot and on front foot[3].

Several studies suggested that core strength plays a significant role in fast and medium fast bowlers in enhancing performance and speed . In fast bowlers lower injuries commonly includes hamstrings tear or strain often related to inadequate warm up during play , inadequate flexibility , strength imbalance between hamstrings and quadriceps. However, also when the core is weak , sometimes the hip flexors or glutes may have to take over which long term could result in an anterior pelvic tilt of the pelvis basically this pelvis tilt can also result in back injury , knee and hip pain or injury. Other injuries include patellar tendinitis, chondral degeneration etc[4].

The current study was carried out to find whether lack of core strength correlate with lower extremity injury or not. The result suggest that there is no statistical significance but a weak correlation between them. The trunk flexor endurance test , the trunk extensor endurance test , the right side and the left side flexor endurance test showed no significance but a weak correlation[5].

krishna et al 2020 *observes* no statistical significant correlation between core endurance scores and shoulder dysfunction among recreational cricket players. Hence this study does not support the use of core stability training in prevention of shoulder dysfunction. But this study couldn't conclude about the effectiveness of core stability training in enhancing performance.

Pooja CA et al 2017 compared core stability with bowling speed in male cricket medium and medium fast bowlers stated that there exist a positive strong correlation between core stability and bowling speed.

Hilligan et al 2008 found that the group with well- developed core stability bowled significantly faster than the group with poorly -developed core stability .Their suggests that well- developed core stability has a positive effect on bowling speed.

According to **Kibler et al. (2006**), players who showed higher levels of strength in the core muscles and therefore obtained better results in the Bunkie test also performed better in the various physical tests.

Willson et al. (2005) that suggested decreased core stability may predispose to injury and that appropriate training may reduce injury. This showed that a well-developed core stability not only increase the performance of the person but also helps in preventing the injuries[16].

CONCLUSION

This study shows weak statistical correlation between core endurance score and lower extremity functional scale score among fast bowlers. But shows significant correlation when compared in between McGill tests.

LIMITATIONS OF STUDY

- Only fast bowlers included in the above study
- Playing experience of minimum 1 year was included
- Small sample size
- Absence of dynamic multi-planer testing procedure.

FUTURE SCOPE OF STUDY

- Further study can be done in larger population or can be also be done in more diverse population, including batsmen, spinners, female cricketers or the comparison between male and female cricketers or comparing two different sports for the generalization of the result.
- Study can be done among amateur bowlers.
- Bunkie test can also be used to assess core muscle endurance as it examines the function of fascial lines by having the subjects hold 5 different planks positions.

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ANNEXURE 1

CONSENT FORM

Title of Project:

Name of Researcher: _____

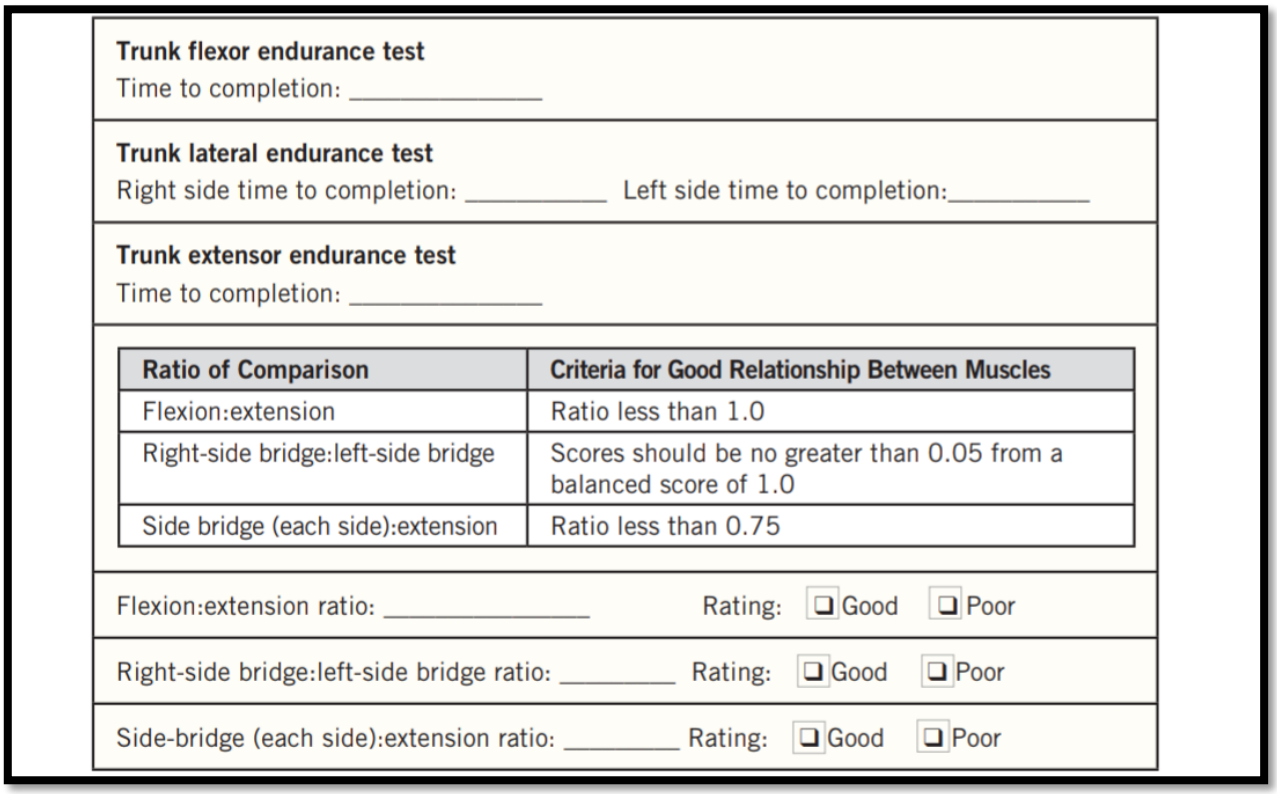
1. I confirm that I have read and understand the information sheet dated _____ for the above study.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

3. I agree to take part in the above study.

Name of Participant Date Signature

ANNEXURE 2



Trunk flexor endurance test
Time to completion: _____

Trunk lateral endurance test
Right side time to completion: _____ Left side time to completion:_____

Trunk extensor endurance test
Time to completion: _____

Ratio of Comparison	Criteria for Good Relationship Between Muscles
Flexion:extension	Ratio less than 1.0
Right-side bridge:left-side bridge	Scores should be no greater than 0.05 from a balanced score of 1.0
Side bridge (each side):extension	Ratio less than 0.75

Flexion:extension ratio: _____ Rating: ❑ Good ❑ Poor

Right-side bridge:left-side bridge ratio: _____ Rating: ❑ Good ❑ Poor

Side-bridge (each side):extension ratio: _____ Rating: ❑ Good ❑ Poor

	Activities	*Exteme Difficulty or Unable tn Perform Activity*	*Quite a Bit of Difficulty*	*Moderate Difficulty*	*A Little Bit of Difficulty*	*No Difficulty*
a.	**Any of your usual work, housework, or school activities.**	**0**	**1**	***2***	**3**	**4**
b.	**Your usual hobbies, recreational or sporting activities.**	**0**	**1**	***2***	**3**	**4**
c.	**(ictting into or out of the bath.**	**0**	**1**	***2***	**3**	**4**
d.	**Walking between rooms.**	**0**	**i**	***2***	**3**	**4**

e.	**Putting on your shoes or socks.**	**0**	**i**	***2***	**3**	**4**
f.	**Squatting.**	**0**	**i**	***2***	**3**	**4**
8	**I if ting an object, like a bag of groceries from the floor.**	**0**	**i**	**2**	**3**	**4**
h.	**Performing light activities around your home.**	**0**	**1**	**2**	**3**	**4**
L	**Performing heaving activities around your home.**	**0**	**1**	***2***	**3**	**4**
i-	**Getting into or out of a car.**	**0**	**)**	***2***	**3**	**4**
k.	**Walking 2 blocks.**	**0**	**1**	***2***	**3**	**4**
L	**Walking a mile.**	**0**	**1**	***2***	**3**	**4**
m.	**Going up or down 10 stairs (about 1 flight of stairs).**	**0**	**i**	***2***	**3**	**4**
n.	**Standinffor 1 hour.**	**0**	**1**	***2***	**3**	**4**
o.	**Sitting for 1 hour.**	**0**	**i**	***2***	**3**	**4**
F*	**Running on even ground.**	**0**	**i**	***2***	**3**	***4***
q-	**Running on uneven ground.**	**0**	**1**	**2**	**3**	**4**
r.	**Making sharp turns while running fast.**	**0**	**1**	**2**	**3**	**4**
s.	**Hopping.**	**0**	**1**	**2**	**3**	**4**
L	**Rolling over in bed.**	**0**	**i**	**2**	**3**	**4**
Column Totals:						

ANNEXURE 3

MASTER CHART

Flx test	Extn test	Rt. Plank	lt. plank	LFS
60	80	50	52	79
58	85	55	52	78
62	90	60	58	79
120	100	60	62	78
90	85	58	56	60
75	60	55	54	60
80	65	58	59	65
50	48	43	45	65
60	68	50	48	65
48	46	43	45	76
55	60	54	53	75
40	48	45	42	76
58	55	48	46	75
60	65	58	56	80
65	60	60	58	77
70	65	60	60	77
80	78	62	60	77
120	90	65	63	77
100	80	60	58	80
90	85	60	58	80
80	75	58	56	80
58	50	51	49	80
68	60	62	60	60
60	58	56	53	65
68	60	58	56	77
70	65	58	57	75

72	68	57	56	56
120	90	62	60	70
100	80	64	62	70
120	100	65	63	70

100	95	68	67	70
80	74	60	62	76
68	65	60	58	67
80	78	62	59	75
90	85	65	63	75
78	72	64	62	75
80	75	66	65	72
85	80	70	68	72
86	78	65	65	72
68	65	60	59	74
72	69	65	63	74
85	80	68	65	74
68	70	68	65	73
75	73	72	70	73
80	82	69	68	78
82	78	70	69	79
78	75	68	65	77
68	72	68	70	80
70	72	69	65	80